COURSE DESCRIPTION

This course covers the basic principles of electronic and software tools used by speech-language pathologists and audiologists in clinical and research settings. The course will first address, at a basic level, simple electrical circuits, transducers, computer hardware and software, and signal processing. These concepts will then be applied to understanding the function of specific instruments and devices used in the speech and hearing sciences.

COURSE NOTES

Required: Course notes are available at the University Bookstore.

SUGGESTED REFERENCES

1. Clinical Measurement of Speech and Voice by Baken and Orlikoff, (available in the Science library)

2. Instrumentation: an introduction for students in the speech and hearing sciences by Decker, (available in the Science library)

COURSE WEBSITE

At the instructor’s discretion, some of the lecture notes and handouts will be made available on the course website (listed above). In addition, this website may also be used for messages related to the course.

COURSE REQUIREMENTS

- **Attendance**: Students are expected to attend class regularly. Attendance will be taken periodically. Anyone who is chronically absent may have their grade lowered or be dropped from the class.
• **Reading & Homework Assignments:** All students are expected to read and study the course notes and any other material provided by the instructor. In addition, homework may be assigned to coincide with some of the lectures. These assignments will be collected and checked but will NOT be included in the final point total for the semester. However, we will make note of whether you have turned in each assignment. The point of the homework assignments is to augment the readings and to provide practice with the type of questions that may be asked on quizzes or exams.

• **Laboratory/Discussion Sections:** All SPH students should be enrolled in both the “R” and “L” sections for this class (e.g. 460R & 460L or 560R & 560L). Specific meeting times will be determined during the first two weeks of class. Once assigned to a weekly lab section, each student is responsible for attending. **Do not switch sections without your T.A.’s approval.** There will be a 5 point quiz given each week.

• **Exams and Quizzes:** There will be two 1 hour exams (50 pts each) given during the semester and a final exam (50 points). In addition, 3 quizzes (15 pts each) will be given periodically.

• **Graduate Students:** Students enrolled in SPH 560 are required to write a paper on a specific instrumentation system, software, or other technological aspect of clinical or laboratory activity. Specific details about the paper will be handed out in class at approximately mid-semester. The paper will be worth up to twenty (20) points of credit.

**Grades**

Course grades will be based on the sum of three (or four) sets of scores (undergraduate maximum pts = 195, Graduate maximum points = 215):

- Two (1) hour examinations (50 points, each) = 100 points
- Final examination = 50 points
- Three quizzes (15 points each) = 45 points
- Graduate project (only for 560) = 20 points

There is no pre-set grading curve for the class. Generally, a point accumulation of 90% of the maximum number of points (330) will earn an “A”, 80% = “B”, and so forth.

**Note:** The laboratory is graded separately from the lecture. (see lab section below).
COURSE OUTLINE

1. Elements of an instrumentation system

2. Basic electricity and electronics
   - Voltage, current, & resistance
   - Ohm’s Law
   - Sources of electricity
   - Circuit symbols
   - Resistive circuits: series, parallel, mixed
   - Reactive circuits: capacitance & inductance

3. The analog world
   - Basic principles of transducers
   - Microphone characteristics
   - Loudspeakers & headphones
   - Amplifiers
   - Filters
   - Video cameras
   - Recording devices

4. Electrical power and safety
   - Distribution of electric power
   - Safety precautions in home, lab, and clinic

Exam I – approx. end of September

5. The digital world I: Computers
   - Hardware components: CPU, memory, input/output devices, permanent storage, etc.
   - Software: operating systems, programming languages
   - Networks

6. The digital world II: Signal and image processing
   - Binary number system
   - Representations of signals
   - Calibration
   - Analog-to-digital conversion
   - Data file formats
   - Basic signal processing: editing, filtering, signal averaging
   - Basic image processing: edge detection, region fill

Exam II – approx. end of October

7. Specific instruments
   - Sound level meter
   - Waveform and spectral analysis systems
   - Imaging systems
   - Electrophysiology: EMG, AER, ABR
   - Measurement of phonation and articulation
   - Measurement of respiration
   - Audiometers
   - Impedance analyzers
   - Recording of otoacoustic emissions

Final Exam
LABORATORY/DISCUSSION SECTIONS (460L/560L)

Laboratory-discussion sessions will be developed to accommodate small groups of students with exact times to be arranged during the first and second weeks of class. Laboratory sections will begin meeting the week of September 9, 2002.

Topics to be addressed in the laboratory/discussion sessions are as follows:

<table>
<thead>
<tr>
<th>Week of</th>
<th>Topic</th>
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<tbody>
<tr>
<td>September 9</td>
<td>Naming things in the lab/clinic - cables, connectors, instruments</td>
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<tr>
<td>September 16</td>
<td>Simple electrical measurements</td>
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<td>September 23</td>
<td>Build an amplifier</td>
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<td>September 30</td>
<td>Consumer electronics</td>
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<td>October 7</td>
<td>Audio and video systems</td>
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<td>October 14</td>
<td>Computer dissection/Build your own computer</td>
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<td>October 21</td>
<td>Computer applications</td>
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<td>October 28</td>
<td>Sound level meters</td>
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<td>November 4</td>
<td>Physiological measures of speech</td>
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<td>November 11</td>
<td>Audiometers</td>
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<td>November 18</td>
<td>Take-home assignment</td>
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<td>December 2</td>
<td>Electrophysiological measures</td>
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<td>December 11</td>
<td>Final quiz will be given in class</td>
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</table>

Laboratory quizzes will be given each week beginning with the second laboratory. Each quiz will be worth 5 points. There will be 12 quizzes given but only the 10 best scores will be used in determining your final grade. The quizzes will be CLOSED BOOK.
Notice

Any student who does not understand or accept the contents and terms of this syllabus or who has a disability or condition that compromises her/his ability to complete the course requirements must notify the instructor in writing within 2 days of receiving this syllabus. A synopsis of the University of Arizona Code of Academic Integrity is attached. All credit will be forfeited for any academic work completed for this class that violates the code.

Code of Academic Integrity

Note: This is a synopsis. The full version can be found at the website, [w3.arizona.edu/~studpubs/policies/cacaint.htm], or at the Dean of Students office, Rm. 203 Old Main.

Integrity is expected of every student in all academic work. The guiding principle of academic integrity is that a student’s submitted work must be the student’s own. Students engaging in academic dishonesty diminish their education and bring discredit to the academic community. Students shall not violate the Code of Academic Integrity and shall avoid situations likely to compromise academic integrity. Students shall observe the generally applicable provisions of this Code whether or not faculty members establish special rules of academic integrity for particular classes. Failure of faculty to prevent cheating does not excuse students from compliance with the Code.

Conduct prohibited by the Code consists of all forms of academic dishonesty, including, but not limited to: cheating, fabrication, facilitating academic dishonesty, and plagiarism as set out and defined in the Code of Conduct, modifying any academic work to obtain additional credit in the same class unless approved in advance by the faculty member; failure to observe rules of academic integrity established by a faculty member for a particular course; and attempting to commit any act prohibited by this Code. Any attempt to commit an act prohibited by these rules shall be subject to sanctions to the same extent as completed acts. The procedures for reviewing a suspected violation follow:

- Faculty–Student Conference – The faculty member must confer with the student within 15 working days of receiving evidence of a suspected violation.

- Appeal to Department Head – Students may appeal the findings made and the sanctions imposed by a faculty member to the Head of the Department in which the course was offered or the Associate/Assistant Dean in colleges with no departments. A student must deliver the written appeal to the Department Head within ten working days of the date on which he/she receives notice of the findings and sanction(s). The Department Head shall render a decision within 15 working days.

- University Hearing Board – If the student wishes to further pursue the matter, or if the Department Head fails to act within the 15 day period, the student may, within ten working days, appeal to a University Hearing Board by providing written notice of appeal to the Dean of Students office. The board shall convene within 30 working days of the time the student files the appeal.
<table>
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<tr>
<th>LEARNER OUTCOMES</th>
<th>ASSESSMENT METHOD</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
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<tr>
<td>1. State the primary elements, of an instrumentation system.</td>
<td>in-class exam, quiz</td>
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<td>2. Solve basic series &amp; parallel circuit problems using Ohm’s Law.</td>
<td>in-class exam, homework, quiz</td>
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<td>3. Draw the symbols of , circuit elements.</td>
<td>in-class exam, homework, quiz</td>
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<td>4. Explain the general operation of a transducer.</td>
<td>in-class exam, homework, quiz</td>
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<td>5. Explain the general operating , principles of microphones, loudspeakers and headphones.</td>
<td>in-class exam, homework, quiz</td>
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<td>6. Give examples of different types of microphones and specify their primary characteristics.</td>
<td>in-class exam, homework, quiz</td>
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<td>7. Explain the basic operation of an amplifier. List different types of amplifiers.</td>
<td>in-class exam, homework, quiz</td>
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<td>8. Identify and explain the components in a video camera.</td>
<td>in-class exam, homework, quiz</td>
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<td>9. List the main components of a computer.</td>
<td>in-class exam, homework, quiz</td>
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<td>10. Demonstrate knowledge of electrical safety considerations.</td>
<td>in-class exam, homework, quiz</td>
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<td>11. Explain the operation of an analog-to-digital converter and a digital-to-analog converter.</td>
<td>in-class exam, homework, quiz</td>
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<td>12. List typically used file formats for signals and images.</td>
<td>in-class exam, homework, quiz</td>
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<td>13. Explain the relation between a waveform and spectral/spectrographic representations.</td>
<td>in-class exam, homework, quiz</td>
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<td>13. Recognize and give general explanations of specific instrumentation systems.</td>
<td>exam, homework, quiz</td>
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